SPK-02210.1
Apr 1989

GENERAL NOTES

1. This guide specification is to be used in the preparation of contract specifications, in accordance with the Sacramento District Specification Manual. It will not be made a part of a contract merely by reference; pertinent portions will be copied verbatim into the contract documents.

2. The section number will be inserted in the specification heading and prefixed to each page number.

3. Where numbers, symbols, words, phrases, clauses, or sentences in this specification are enclosed in the following manner: [ ], a choice or modification must be made; delete inapplicable portion(s) carefully. Where blank spaces occur in sentences, insert the appropriate data. Where entire paragraphs are not applicable, they should be deleted completely.

4. Paragraph 1: The listed designations for publications are those that were in effect when this guide specification was being prepared. Designations that are known to be out of date at the time of advertising will be changed to those current at that time, and the nomenclature, types, grades, classes, etc., referenced in the guide will be checked for conformance to the latest revision or amendment. To minimize the possibility of error, the letter suffixes, amendments, and dates indicating specific issues will be omitted elsewhere in the specification. It is essential, therefore, that the list of applicable publications be retained in the contract specifications.

5. Some paragraphs contain parentheses. Inapplicable parenthetical items will be deleted and all parentheses removed. Additional notes herein pertain to some of these paragraphs.

6. The following paragraphs contain blanks to be completed as appropriate by the Contracting Officer.

   2.1 2.2 4.1 5.

7. This guide specification, as written, covers all excavating, filling, backfilling, grading, and associated operations that may be required under a contract covering grading, roads and streets, building foundations, parking and storage areas, utilities, for small projects where the first floor area of the building is less than 10,000 square feet and/or the amount of paving is less than 2,000 square yards. There are certain operations and items of construction that may be omitted as not being applicable to the particular work under consideration, or may, for certain reasons, be performed as independent operations or as subsidiary operations under other contracts. Any portions of the provisions of this specification covering the various work items that are not applicable to the work under consideration or can be more expeditiously or advantageously performed under other contracts will be deleted. Also certain items such as base or subbase course may be added to this specification when quantities are small and it is advantageous to eliminate additional sections of the specifications. This specification and/or any other specification affected will be revised to fit local conditions.

TECHNICAL NOTES

A. Paragraph 2.1: Satisfactory material will be defined in accordance with locally available materials, design slopes, etc., and all suitable classes will be listed in the project specifications in accordance with the Unified Soil Classification System, ASTM D 2487.

B. Paragraph 2.2: Unsatisfactory material will be defined in accordance with locally available materials, design slopes, etc., and all unsuitable classes will be listed in the project specification in accordance with the Unified Soil Classification System, ASTM D 2487.

C. Paragraphs 2.1, 2.2, and 2.3: These paragraphs shall be deleted and a paragraph similar to the one below shall be inserted when the foundation report indicates that the local excavated materials are satisfactory for fill or backfill. In such cases, the classification

determined in accordance with ASTM D 2487 need not be stated and all references to cohesionless and cohesive materials throughout the specification shall be deleted and the compaction requirements revised to comply with the foundation report:

"2.1 Satisfactory Materials: Local excavated [and borrow] materials are satisfactory for preparation of subgrade and embankment except organic material, trash, etc. and materials containing excessive moisture which do not readily compact or support construction equipment."

D. Paragraph 4.1: Requirements for merchantable timber may be deleted when the timber from felled trees will be of insufficient commercial value to warrant salvaging. When timber is of merchantable value, the blank shall be filled. The paragraph may be modified for disposal of material, including merchantable timber for which the facility has no use, off Government-controlled land at the Contractor's responsibility. Other methods of disposal on Government-controlled land shall be specified when burning will be hazardous or will cause objectionable air pollution.

E. Paragraph 5 and 15: If topsoil within the limits of work area is unsuitable, determination shall be made whether it is more economical to treat surface soil of graded areas with fertilizers and amendments so as to be conducive to turf establishment rather than transport topsoil to the project site. If topsoil or treated surface soils are suitable for turfing, the blank in paragraph 5 shall be filled, and the requirements for treating soil with fertilizers and amendments shall be included in paragraph 15. Paragraph 5 shall be deleted if topsoil or treated soil is unsuitable for turfing, and requirement shall be included in paragraph 15 for Contractor to furnish topsoil. Paragraph 15 shall be deleted if topsoiling is specified under another section or is not required.

F. Paragraphs 6.1, 6.1.1, and 6.1.2: If classification of materials appears desirable because of existing soil conditions, as determined by observation or borings, the specification provisions governing such requirements, including requirements for blasting if necessary, shall be retained.

G. Paragraphs 6.1.1, 7., 7.2, and 7.3: Paragraphs and portions of

paragraphs pertaining to rock excavation shall be deleted when no rock excavation is performed.

H. Paragraphs 7., 7.4, and 9: Corrective treatment may be required if foundation investigation indicates a heterogeneous condition of the soil profile or the possibility of isolated pockets of unsatisfactory materials. Such corrective treatment will require the excavation and removal of unsatisfactory materials, particularly under footings supporting structures that are sensitive to differential settlement, and replacing with satisfactory compacted materials. Where backfill and fill is placed below water surface, add requirements for materials to consist of clean sandy gravel containing not less than 50 percent gravel and not more than 2 percent passing the No. 200 sieve, require placement in lifts not exceeding 2 feet in vertical thickness, and delete requirements for compactor until material placed is 2 feet above the water surface at the time of construction. When dewatering is required for proper placement of fill or backfill, add a paragraph describing these requirements. Cross reference this paragraph and paragraph 2.1 when special materials are required for specific conditions.

I. Paragraph 7.4: The last sentence may be revised to require specific method of water removal.

J. Paragraphs 9, 11, 11.1, and 11.2: Contract specifications for non-frost-susceptable fill and backfill shall state the gradation requirements listed in TM 5-818-2. For fill under critical structures, materials with ML, MH, and CH classification shall be specified as unsatisfactory if at all feasible from an economic or material-availability standpoint. If such materials must be used, the specification shall point out the critical nature of the materials and the control difficulities to be anticipated. Organic materials and topsoil having OL, OH, and PT classification shall not be used in fill or backfill.

K. Paragraphs 9., 10., and 11.2: It is generally important to specify compaction of the ground surface for fills and a high degree of compaction in fills under structures to minimize settlement and to insure stability of a structure. In addition to the criteria set forth in TM 5-818-1/AFM 88-3, Chapter 7, the following factors shall be considered in establishing the specific requirements:

a. The sensitivity of the structure to total and/or differential settlement as related to the structural design. This is particularly

true of structures to be founded partly on fill and partly on natural ground.

b. The ability of normal compaction equipment to produce the desired densities in existing or locally available materials within a reasonable range of molding mositure content. If considered essential, special equipment shall be specified.

c. The compaction requirements for clean, cohesionless, granular materials will be generally higher than those for cohesive materials because cohesionless materials readily consolidate when subjected to vibrations. For structures with critical stability requirements and settlement limitations, the minimum density requirements may be altered. If only a cohesionless soil or only a cohesive soil is used, the inapplicable values will be deleted.

d. The exception to generally required high degree of compaction in fills and backfills is in swelling soils. Where it is necessary to use materials having swelling characteristics, usually CL or CH classifications, the specified degree of compaction will be related to laboratory test results for swelling under a considerable range of molding moisture and compactive effort. In swelling soils, it is important to specify a density and molding moisture range that will enable the soil to stay stable, striking a reasonable balance between potential swell and excessive settlement under load, even at the expense of accepting a reduced bearing capacity. If possible, soils with swelling characteristics shall be classified as unsatisfactory material, particularly under critical stability structures.

e. ASTM D 1557, Method B or D, is satisfactory for establishing moisture density characteristics of a material in most cases. However, other modifications may be necessary as discussed under soil classification and tests in TM 5-824-2/AFM 88-6, Chapter 2. The procedures and precautions in the subgrade compaction paragraphs of TM 5-824-2/AFM 88-6, Chapter 2 shall be considered in establishing minimum density requirements for a particular project.

L. Paragraph 14: The compated thickness of capillary water barrier shall be indicated and shall not be less than 6 inches. Density requirements may be added if desired. The paragraph will be deleted where site conditions make the barrier and foundation drainage unnecessary. If testing of the crushed rock is not required, delete paragraph 1.2.

M. Paragraph 15: Soil treatment shall be specified for all types of construction where termites are likely to establish colonies and make concealed access to wood construction, including wood doors, windows,

N. Paragraph 5.2.2.2: When tops of footings are more than 30 inches below finished grade, soil treatment agents shall be applied at the rate of 4 gallons per 10 linear feet in a strip 1 foot wide near level of top of footings before placing backfill, as each 1-foot lift is completed, and just below finished grade.

SPK-02210.1
April 1989

INDEX

SECTION 02210.1

EARTHWORK

SECTION 02210.1

EARTHWORK

1. APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 Corps of Engineers Manual:

EM 385-1-1 Safety and Health Requirements Manual (April 1981, Rev. Oct 1987).

1.2 American Society for Testing and Materials (ASTM) Publications:

C 127-84 Specific Gravity and Absorption of Coarse Aggregate.

C 131-81 Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

D 1556-82 Density of Soil in Place by the Sand-Cone Method.

D 1557-78 Moisture-Density and Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.5-kg) Rammer and 18-in. (457-mm) Drop.

D 2217-85 Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.

D 2487-85 Classification of Soils for Engineering Purposes.

D 4318-84 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

2. DEFINITIONS:

2.1 Satisfactory Materials: Satisfactory materials include materials classified in ASTM Standard Method D 2487 as GW, GP, SW, , , and .

2.2 Unsatisfactory Materials: Unsatisfactory materials include materials classified in ASTM Standard Method D 2487 as PT, OH, OL, , , and .

2.3 Cohesionless and Cohesive Materials: Materials classified as GM and SM are identified as cohesionless only when the fines have a plasticity index of 0. All other materials will be identified as cohesionless if the fines have a plasticity index less than 5 and cohesive if the plasticity index is 5 or greater. The plasticity index of a material shall be determined in accordance with ASTM D 4318 using Procedure B in ASTM D 2217.

2.4 Degree of Compaction: Degree of compaction required is expressed as a percentage of the maximum density obtained by ASTM Test Method D 1557, Method B or D.

2.5 Tests as Required for the Determination of Satisfactory and Unsatisfactory Material shall be performed by the Contractor and test reports shall be furnished to the Contracting Officer.

3. PROTECTION OF EXISTING STRUCTURES, UTILITIES, WORK, AND VEGETATION is
specified in the Contract Clauses.

4. CLEARING AND GRUBBING: The areas within lines 5 feet outside of each building and structure line shall be cleared and grubbed of trees, stumps, roots, brush, and other vegetation, debris, existing foundations, pavements, utility lines, structures, fences, and other items that would interfere with construction operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material placed and compacted in accordance with paragraph, COMPACTION.

4.1 Disposal of Cleared and Grubbed Materials: [Cleared and grubbed material shall be disposed of outside the limits of Government controlled land and at the Contractor's expense.] [Materials removed and not designated as merchantable timber or salvage material shall be burned where directed and in a manner that will avoid fire hazards to existing structures, construction in progress, stored materials, trees, and vegetation. The Contractor shall be responsible for compliance with all Federal, State, and local laws and regulations and for reasonable practice relative to the building of fires. Fires shall be kept under constant attendance until burned out or extinguished. Material that cannot be burned shall be disposed of in [designated] [approved] spoil areas. When approved in writing, logs and stumps may be disposed of without burning under approved conditions and in approved areas. [Timber from which saw logs, pulpwood, poles, ties, or cordwood can be produced shall be considered as merchantable timber. Merchantable timber shall be trimmed of limbs and tops, shall be sawed into -foot lengths, and stockpiled where and as directed].]

5. [TOPSOIL: Topsoil shall be stripped to a depth of inches within the designated grading lines. Topsoil shall be kept free from subsoil, clay lumps, brush, objectionable weed growth, litter, stones larger than 2 inches in diameter, stumps, roots, and other material that would interfere with planting and maintenance operations. Topsoil shall be [transported and deposited in storage piles convenient to areas that are to receive applications of topsoil later] [spread on areas prepared for topsoil.]

6. CLASSIFICATION OF EXCAVATION: [Excavation will be unclassified regardless of the nature of material encountered.] [All excavation hereinafter specified shall be done on either a classified or unclassified basis, as provided for under the item designations of the contract.]

areas within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Satisfactory material removed below the depths indicated without specific direction of the

Contracting Officer shall be replaced at no additional cost to the Government, to the indicated excavation grade with satisfactory materials, except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations [and overbreak in rock excavation]. Satisfactory material shall be placed and compacted as specified in paragraph FILLS. Surplus satisfactory excavated material not required for fill or backfill and unsatisfactory excavated material shall be disposed of [in designated waste or spoil areas] [by the Contractor outside the limits of the Military reservations]. During construction, excavation and filling shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or backfill in excess of that produced by excavation within the grading limits shall be excavated from borrow areas as specified in paragraph SELECTION OF BORROW MATERIAL.

7.1 Protection or Removal of Utility Lines: Existing utility lines that are shown on the plans or the locations of which are made known to the Contractor prior to excavation and that are to be retained, if damaged, shall be repaired by the Contractor at no expense to the Government. In the event that the Contractor damages existing utility lines that are not shown on the plans or the locations of which have not been made known to the Contractor, report of such damage shall be made immediately to the Contracting Officer. If the Contracting Officer determines that the repairs shall be made by the Contractor, such repairs will be ordered under paragraph: CHANGES in CONTRACT CLAUSES of the contract. When utility lines that are to be removed are encountered within the area of operations, the Contractor shall notify the Contracting Officer in ample time for the necessary measures to be taken to prevent interruption of the services.

7.2 Blasting: [Storage of explosives, where permitted on Government-controlled property, shall be only where directed. Blasting shall be done with explosives of such quantity and power and fired in such sequence and locations as will not injure personnel, lossen the rock outside of the excavation lines shown, damage or crack rock against which concrete is to be placed, damage property, or damage existing work or other portions of new work. The Contractor shall be responsible for damage and excess excavation caused by blasting operations.] [Blasting will not be permitted.]

7.3 Utility Trenches: Trenches shall be of the necessary width for proper laying of pipe, cables, or ducts. The banks of pipe trenches shall be as nearly vertical as practicable. Care shall be taken not to overexcavate. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length, except for the portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe

joints, and as hereinafter specified. Bell holes and depressions for joints shall be dug after the trench bottom has been graded, and, in order that the pipe rest on the prepared bottom for as nearly its full length as practicable, bell holes and depressions shall be only of such length, depth, and width as required for properly making the particular type of joint. Stones shall be removed as necessary to avoid point bearing. [Rock, where encountered shall

be excavated to a minimum overdepth of 6 inches below the bottom of the pipe and the overdepth shall be backfilled with a granular satisfactory material as specified hereinbefore.] Except as hereinafter specified for wet or otherwise unstable material, overdepths shall be backfilled as necessary and with materials specified for backfilling the lower portion of trenches. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe is encountered in the bottom of the trench, [and overdepth is not indicated on the drawings,] such material shall be overexcavated to a depth to allow for construction of a stable pipe bedding. The trench shall be backfilled to the proper grade with satisfactory materials. [Where indicated on the drawings, trenches shall be excavated to [an overdepth of inches] [the depth indicated] and backfilled to the proper grade with satisfactory material.] Separate trenches shall be excavated for sewer, water, and gas pipes unless otherwise indicated. Care shall be exercised to minimize disturbance to the [capillary water barrier] [and compacted subgrade].

7.3.1 Sanitary Sewers: The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall shall not exceed 8 inches on either side of the pipe. The width of the trench above that level shall be as wide as necessary for sheeting and bracing and the proper performance of the work. The bottom of the trench shall be rounded so that at least the bottom quadrant of the pipe shall rest firmly on undisturbed soil or satisfactory backfill for as nearly the full length of the barrel as proper jointing operations will permit. This part of the excavation shall be done manually only a few feet in advance of the pipe laying by men skilled in this type of work.

7.3.2 Gas-Distribution Lines: Unless otherwise indicated, trenches shall be excavated to a depth that will provide not less than 2 feet of cover over the top of the pipe from the existing ground surface or the indicated finished grade [, whichever is lower,] and that will avoid interference of the gaslines and other utilities.

7.3.3 Waterlines: Unless otherwise indicated, trenches shall be graded to avoid high points with the necessity of placing vacuum and relief valves in the waterlines. Trenches shall be of a depth to provide a minimum cover over the top of the pipe of 2.5 feet in grassed areas and 3 feet in paved areas from the existing ground surface or the indicated finished grade [, whichever is lower,] and to avoid interference of the waterlines with other utilities.

7.3.4 Electrical System: The banks of trenches for electrical cables and duct lines need not be kept vertical but may be sloped or widened to such general limits as may be set by the Contracting Officer, provided there is no interference with other utilities. Overexcavating and backfilling with

cohesionless material where rock is encountered will not be required except for a gradual cushioning towards points of abrupt dropoff of the rock to levels considerably below the grade of the duct. The bottom of the trenches for [direct buried cable] [conduit] shall be smooth and free of stone and sharp objects. Where the bottom of the trench comprises materials other than sand or earth, a 3-inch layer of sand or stone free earth shall be laid in the

bottom of the trench and compacted to the approximate density of the surrounding soil. Trenches shall be a depth to provide a minimum cover over the top of the [direct buried cable] [conduit] [of 2.0 feet] [duct] [of 18-inches] from the existing ground surface or the indicated finished grade [, whichever is lower,] and that will avoid interference of the [duct] [direct buried cable] [conduit] with other utilities.

7.3.5 Excavation for Appurtenances: Excavation for manholes and similar structures shall be sufficient to leave at least 12 inches in the clear between the outer surfaces and the embankment or timber that may be used to hold and protect the banks. Any overdepth excavation below such appurtenances that has not been directed will be considered unauthorized and shall be refilled with sand, gravel, or concrete, as directed, at no additional cost to the Government.

7.4 Drainage: Excavation shall be performed so that the area of the site and the area immediately surrounding the site and affecting operations at the site will be continually and effectively drained. Water shall not be permitted to accumulate [in crawl-space areas and] in the excavation. The excavation shall be drained by pumping or other satisfactory methods to prevent softening of the foundation bottom, [undercutting of footings,] or other actions detrimental to proper construction procedures.

7.5 Shoring: Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities in accordance with Corps of Engineers Manual EM 385-1-1. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

8. SELECTION OF BORROW MATERIAL: Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained from the borrow areas [shown] [or] [from approved sources off Government-controlled land at the Contractor's responsibility.] The necessary clearing and grubbing of borrow areas, disposal and, where permitted, burning of debris therefrom, the developing of sources including any access roads for hauling and the necessary right-of-way, and the satisfactory drainage of the borrow areas shall be considered as incidental items to borrow excavation. [The Contracting Officer shall be notified sufficiently in advance prior to opening any borrow area to permit elevations and measurements of the undisturbed ground surface to be taken.] Borrow areas shall be neatly trimmed and drained after borrow excavations are completed.

9. BACKFILL: Backfill adjacent to any and all types of structures shall be of satisfactory materials placed and compacted as specified under paragraph FILLS. Backfilling shall not begin until construction below finish grade has

been approved, forms removed, and the excavation cleaned of trash, debris and loose soil. Backfill shall be brought to indicated finish grade [and shall include backfill for outside grease interceptors and underground fuel tanks]. Backfill shall not be placed in wet areas. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining

walls than a distance equal to the height of backfill above the top of footings; the area remaining shall be compacted in layers not more than 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. All inspections and tests shall be made by the Contractor and approved by the Contracting Officer.

9.1 Backfill for Utilities: The trenches shall not be backfilled until all pressure tests are performed and until the utilities systems as installed conform to the requirements specified in the several sections covering the installation of various utilities. [Where, in the opinion of the Contracting Officer, damage is likely to result from withdrawing sheeting, the sheeting shall be left in place and the contract price will be adjusted accordingly.] Trenches shall be backfilled to the ground surface with satisfactory material that is suitable for the compaction as hereinafter specified. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as approved. The surface shall be restored to its original condition as near as practical and as hereinafter specified. Pavement, base course, [subbase materials,] and compacted subgrade disturbed by trenching operations shall be replaced [in an acceptable manner with materials equal to the adjacent compacted subgrade, base course, [subbase materials] and pavement for a minimum distance of 12 inches on each side of the trench.] [, as directed, in accordance with pavement details shown on the drawings.]

9.1.1 Backfill, Lower Portion of Trench: Backfill material shall be deposited in 6-inch maximum thickness layers and compacted with suitable tampers to the density of the adjacent soil or graded as hereinafter specified until there is a cover of not less than 2-feet over sewers and 1-foot over other utility lines. The backfill material in this portion of the trench for all utilities except direct buried cable and conduit shall consist of material at a moisture content that will facilitate compaction, free from stones larger than 3-inches in any dimension and hard clods larger than 6-inches in any dimension, except where pipe is coated or wrapped for protection against corrosion the backfill material shall be free from stones larger than 1-inch in any dimension. Backfill material for direct buried cable or conduit shall consist of sand or stone free earth. Special care shall be taken not to damage the coating or wrapping of pipes.

9.1.2 Backfill, Remainder of Trench: Except for special materials for pavements, the remainder of the trench shall be backfilled with material that is free of stones larger than 6-inches or 1/2 the layered thickness, whichever

is smaller, in any direction. Backfill material shall be deposited in layers not exceeding the thickness specified herein, and each layer shall be compacted to the minimum density specified as applicable to the particular area, except that in areas not subject to vehicular movement, settling of granular, noncohesive material with water will be permitted. Degree of compaction shall be as follows:

9.1.2.1 Under pavement: Six inch layers, 90 percent ASTM D 1557 maximum density for cohesive soils and 95 percent ASTM D 1557 maximum density for cohesionless soils up to the elevations at which the requirements for pavement subgrade materials and compaction control.

9.1.2.2 Under turfed or seeded lawn areas and sidewalks: Twelve inch layers, 85 percent ASTM D 1557 maximum density for cohesive soils and 90 percent ASTM D 1557 maximum density for cohesionless soils.

9.1.2.3 Under all other areas: Two foot layers, density approximately equal to the adjacent soil.

10. PREPARATION OF GROUND SURFACE FOR FILLS: Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to the specified density.

11. FILLS: Fills shall be constructed at the locations and to lines and grades indicated. The completed fill shall conform to the shape of the typical sections indicated or shall meet the requirements of the particular case. Material removed from the excavation shall be used in forming the fill. Fill shall be satisfactory material and shall be free from roots, other organic material, and trash, and from stones having maximum dimension greater than 6 inches. [No frozen material will be permitted in the fill.] Stones having a maximum dimension larger than 4 inches shall not be permitted in the upper 6 inches of fill. The placing of satisfactory materials and compaction shall be as specified in paragraphs PLACING and COMPACTION.

11.1 Placing: Satisfactory material shall be placed in horizontal layers not exceeding 8 inches in loose depth for power compated layers and not exceeding 4 inches in loose depth for hand-compacted layers and then compacted. No material shall be placed on surfaces that are wet or muddy.

11.2 Compaction: Compaction shall be performed by rolling with approved tamping rollers, pneumatic-tired rollers, three-wheel power rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary to provide the moisture content within the range or moisture as determined under paragraph DENSITY that will readily facilitate obtaining the specified compaction with the equipment used. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 6 inches, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to

a depth of 12 inches and compacted as specified for the adjacent fill. Each layer shall be compacted to not less than the percentage of maximum density specified below:

Fills and backfill	Percent ASTM D 1557 maximum density Cohesive material	Cohesionless material
Under proposed structures, building slabs, steps, and paved areas	90	95
Under sidewalks and grassed areas	85	90
[Shoulders for paved areas	As shown on the drawings]	

Subgrades	Percent ASTM D 1557 maximum density Cohesive material	Cohesionless material
Under building slabs, steps, top 12 inches	90	95
[Subgrade for pavements	As shown on the drawings]	
Under sidewalks, top 6 inches	85	90

11.3 Tests shall be performed by the Contractor, and test reports shall be furnished the Contracting Officer.

11.3.1 Density will be measured in the field in accordance with ASTM D 1556. The maximum density at optimum moisture will be determined in the laboratory in accordance with ASTM D 1557, Method B or D.

11.3.2 Check test samples shall be furnished by the Contractor to the Contracting Officer upon request.

11.3.3 Retesting: In the event field tests show inadequate compaction the affected layer or layers shall be recompacted or scarified and recompacted, including addition of water, retested, and the procedure repeated as required, to provide the compaction specified hereinabove, as approved.

11.4 Reconditioning of Subgrades: Where approved compacted subgrades are

disturbed by Contractor's subsequent operations or adverse weather, the subgrades shall be scarified and compacted as specified hereinbefore to the required density prior to further construction thereon. Recompaction over underground utilities and heating lines shall be by hand tamping.

12. TEST FOR DISPLACEMENT OF SEWERS: Sewer mains shall be checked to determine whether any displacement of the pipe has occurred after the trench has been backfilled to 2 feet above the pipe and tamped as specified. The test shall be as follows: A light shall be flashed into the sewerline by means of a flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the pipe line shows poor alignment, displaced pipe, or any other defects, the defects shall be satisfactorily remedied.

13. FINISHING: The surface of all excavations, fills, and subgrades shall be finished to a reasonably smooth and compact surface substantially in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be 1/10 foot of the grades and elevations indicated. The finished surface of the subgrade for roadways shall not show deviation greater than 1/2 inch when tested with a 10-foot straightedge applied both parallel and at right angles to the centerline of the area.

[14. CAPILLARY WATER BARRIER: Capillary water barrier under concrete floor and area-way slabs on grade shall consist of clean, crushed rock. The maximum particle size shall be 1-1/2 inches and uniformly graded to the No. 4 sieve size with not more than 5 percent passing the No. 4 sieve size. The capillary water barrier shall be placed directly on the subgrade meeting density and elevation requirements. The barrier shall be of 6 inches thick and constructed in one layer compacted with a minimum of four passes of a hand-operated plate-type vibratory compactor. [Crushed rock when tested for abrasion shall have a loss not greater than 40 when tested in accordance with ASTM Method C 131.]]

15. SOIL TREATMENT: Just prior to placing concrete [slab on grade] [basement slab] and just prior to backfilling around foundations for structures, soil treatment shall be applied as hereinafter specified. Soil-treatment agents shall be delivered to the job site in sealed and labeled containers bearing the manufacturer's warnings to be observed in the handling and use of soil-treatment agents. Labels shall bear evidence of registration under Federal Insecticide, Fungicide, and Rodenticide Act and concentrations and application rates used shall conform to the labels. In the event soil treatment as specified herein differs from EPA regulations, EPA regulations shall govern.

15.1 Materials: One of the following materials shall be used:

15.1.1 Chlordane, 1.0 percent concentration in a water emulsion.

15.1.2 Dieldrin, 0.3 percent concentration in a water emulsion.

15.1.3 Aldrin, 0.5 percent concentration in a water emulsion.

15.1.4 Heptachlor, 0.5 percent concentration in a water emulsion.

15.2 Application: The Contractor shall notify the Contracting Officer five (5) days prior to application of soil treatment. Application shall be in conformance with the guidance of the [base] [post] entomologist or his designated qualified representative. Soil treatment agents shall be applied in accordance with the precautions on the label and in the following quantities:

15.2.1 Under [Slabs on Grade] [Basement Slabs]: Apply [1] [1-1/2] gallon[s] per 10 square feet as overall treatment. Around utility openings for pipes, ducts, conduits, and other slab penetrations, 1/2 gallon per square foot shall be applied. Under the exterior perimeter of the slab and under expansion joints, 4 gallons per 10 linear feet in a strip 6 inches wide shall be applied.

15.2.2 Foundation Walls of Buildings:

15.2.2.1 Concrete Foundation Building Walls: Apply 4 gallons per 10 linear feet in a strip 6 inches wide along exterior side of foundation wall just below finished grade, along interior side of the foundtion walls of crawl spaces, around supporting piers, and along both sides of interior partition foundation walls.

15.2.2.2 Concrete-Masonry-Unit Building Foundation Walls: Apply 4 gallons per 10 linear feet in a strip 6 inches wide along exterior side of foundation walls with one-third near level of top of footings before placing any backfill, one-third between footings and finished grade, and remainder just below finished grade. Apply 4 gallons per 10 linear feet in a strip 6 inches wide along interior side of the foundation walls of crawl spaces, around supporting piers, and along both sides of interior partition foundation walls.

16. [SPREADING TOPSOIL: Areas outside the building lines [from which topsoil has been removed] [as shown] shall be topsoiled. The subgrade shall be pulverized to a depth of 2 inches by disking or plowing for bonding with the subsoil. Topsoil shall then be uniformly spread and graded to the thickness, elevations, and slopes shown, and compacted by one pass of a cultipacker, roller, or other approved equipment weighing 100 to 160 pounds per linear foot of roller. Topsoil shall not be placed when the subgrade is excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.]

17. PROTECTION: Settlement or washing that occurs in graded, [topsoiled] or backfilled areas prior to acceptance of the work shall be repaired and grades reestablished to the required elevations and slopes. Fills and excavations shall be kept shaped and drained. [Ditches and drains along subgrade shall be maintained in such a manner as to drain effectively at all times.] [The finished subgrade shall not be disturbed by traffic or other operations and

shall be protected and maintained by the Contractor in a satisfactory condition until subbase, base or pavement is placed.] The storage or stockpiling of materials on the finished subgrade will not be

permitted. [No subbase, base course, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing or pavement be placed on a muddy, spongy, [or frozen] subgrade.]

18. CONSTRUCTION QUALITY CONTROL: Attention is directed to SECTION: CONSTRUCTION QUALITY CONTROL which requires the Contractor to perform quality control inspection, testing, and reporting.

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- REMINDER -

Located at the front of these specifications are the Contract Clauses, Special Clauses and Division I GENERAL REQUIREMENTS of the Technical Specifications, which apply to every aspect of this contract including the work in this section whether performed by Prime Contractor, subcontractor, or supplier.